PHYS 301
HOMEWORK #2

Due : 1 Feb. 2016

1. In this assignment, you will find expressions for velocity and acceleration in spherical polar coordinates.

a) In the first homework assignment, you developed expressions that should allow you to determine the scale factors for the r, θ, ϕ coordinate system by inspection. Write down the scale factors for the spherical polar coordinate system; you need not show any work for this part (and this part only), merely state the results.(5)

b) Write the position vector solely in terms of spherical polar coordinates (that is, write **r** in terms of r, θ, ϕ and $\hat{r}$, $\hat{\theta}$, $\hat{\phi}$). In order to do this, you will need to express the unit vectors, $\hat{r}$, $\hat{\theta}$, $\hat{\phi}$ in terms of $\hat{x}$, $\hat{y}$, and $\hat{z}$; and then express the Cartesian unit vectors in terms of $\hat{r}$, $\hat{\theta}$, $\hat{\phi}$. You may use techniques of matrix algebra if you know them; but show all work.

When you have this information, write the position vector in spherical polar coordinates. (20)

c) Use this expression for **r** and find the velocity (d**r**/dt) and also the acceleration (d**v**/dt) in spherical polar coordinates. (25)